

Curriculum Vitae

Personal Data : Warren William WAKARCHUK

Institute for Biological Sciences
National Research Council
100 Sussex Drive, Ottawa, Ontario,
K1A 0R6
Phone: (613)-952-4299
Fax: (613)-941-1327
EMAIL warren.wakarchuk@nrc.ca
Birthdate: October 19, 1959
Nationality: Canadian

EDUCATION

1984-87: **Doctorate** in Microbiology from the University of British Columbia, Vancouver, British Columbia. Thesis title: The characterization of the *abg* (β -glucosidase) gene of an *Agrobacterium*. Research supervisors: Dr. R.A.J. Warren, Dr. R.C. Miller Jr., and Dr. D.G. Kilburn.

1981-84: **Master of Science** degree in Microbiology from the University of British Columbia, Vancouver, British Columbia. Thesis title: The identification and partial characterization of a third recombinant plasmid encoding a cellulase from *Cellulomonas fimi*. Research supervisors: Dr. R.A.J. Warren, Dr. R.C. Miller Jr., and Dr. D.G. Kilburn.

1978-81: **Bachelor of Science degree** in Microbiology from the University of British Columbia, Vancouver, British Columbia. Undergraduate thesis title: Further studies on the detoxification of *Pseudomonas aeruginosa* exotoxin A using glutaraldehyde. Research Supervisor: Dr. D. Syklocha.

1976-78: General science program at the Medicine Hat Junior College, Medicine Hat, Alberta, Canada.

EMPLOYMENT HISTORY

Promotion to **Senior Research Officer** of the NRC, July 1999.

Project leader of the Glycosyltransferase project within the Immunochemistry section of the Institute for Biological Sciences of the NRC.

Appointment as **Associate Research Officer of the NRC** April 1994,

Research associate in the laboratory of Dr. Makoto Yaguchi at the NRC laboratories in Ottawa as part of the Protein Engineering Network Centre of Excellence (PENCE). 1990 - 1994

Post-doctoral fellow in the laboratory of Dr. Stephen G. Withers. Jan. 1990 - Jun. 1990

Post-doctoral fellow In the laboratory of Dr. Christoph F. Beck. Aug. 1987 - Sept. 1989

EXHIBIT D

FELLOWSHIPS

My postdoctoral work in Germany was supported by both Alexander Von Humboldt and Izaak W. Killam postdoctoral research fellowships.

AWARDS/APPOINTMENTS

- Appointment to the editorial board of the Journal of Biological Chemistry, July 2003
- Entrepreneurship/Innovation award of the NRC Institute for Biological Sciences 1998
- Teamwork award of the NRC Institute for Biological Sciences 1997

PUBLICATIONS

Journal articles (Total 61)

1. Yan, F., Mehta S., Eichler, E., Wakarchuk, W.W., Gilbert, M., Schur, M.J. and Whitfield D.M.. 2003. Simplifying oligosaccharide synthesis: efficient synthesis of lactosamine and sialylated lactosamine oligosaccharide donors. *J. Org. Chem.* 68:2426-31
2. Kitov, P. I., Paszkiewicz, E., Wakarchuk, W.W. and Bundle, D.R. 2003. Preparative-scale chemoenzymatic synthesis of large carbohydrate assemblies using alpha (1-->4)-galactosyltransferase/UDP-4'-Gal-epimerase fusion protein. *Methods Enzymol.* 362:86-105
3. Wakarchuk, W.W. and Cunningham A.M. 2003. Capillary electrophoresis as an assay method for monitoring glycosyltransferase activity. *Methods Mol. Biol.* 213:263-74
4. Thibault, P., Martin, A., Gilbert M., Wakarchuk, W.W. and Richards J. C. 2003. Analysis of bacterial glycolipids by capillary electrophoresis-electrospray mass spectrometry: *Haemophilus influenzae* and *Neisseria meningitidis* lipopolysaccharides. *Methods Mol. Biol.* 213:241-59
5. Antoine, T., Priem, B., Heyraud, A., Greffe, L., Gilbert, M., Wakarchuk, W.W., Lam, J.S and Samain, E. 2003. Large-Scale In Vivo Synthesis of the Carbohydrate Moieties of Gangliosides GM1 and GM2 by Metabolically Engineered *Escherichia coli*. *Chembiochem.* 4:406-12
6. Withers, S., Wakarchuk, W.W and Strynadka, N. 2002. One step closer to a sweet conclusion. *Chem Biol.* 9(12):1270-3.
7. St. Michael, F., Szymanski, C.M., Li, J., Chan, K.H., Khieu, N.H., Larocque, S., Wakarchuk, W.W., Brisson J.R., and Monteiro, M.A. 2002. The structures of the lipooligosaccharide and capsule polysaccharide of *Campylobacter jejuni* genome sequenced strain NCTC 11168. *Eur J Biochem* 269(21):5119-36
8. Inzana, T. J., Glindemann, G., Cox, A. D., Wakarchuk, W., and Howard, M. D. 2002. Incorporation of N-acetylneuraminic acid into *Haemophilus somnus* lipooligosaccharide (LOS): enhancement of resistance to serum and reduction of LOS antibody binding. *Infect. Immun.* 70:4870-4879

9. Karwaski, M. F., Wakarchuk, W. W., and Gilbert, M.. 2002. High-level expression of recombinant *Neisseria* CMP-sialic acid synthetase in *Escherichia coli*. *Protein Expr. Purif.* **25**:237-240.
10. Ly, H.D., Loughheed, B., Wakarchuk, W.W. and Withers, S.G 2002 Mechanistic studies of a retaining α -galactosyltransferase from *Neisseria meningitidis*. *Biochemistry*, 41:5075-85.
11. Gilbert, M., Karwaski, M.-F., Bernatchez, S., Young, N.M., Taboada, E., Michniewicz, J., Cunningham, A.-M. and Wakarchuk, W.W. 2002. The genetic basis for the variation in the lipooligosaccharide of the mucosal pathogen, *Campylobacter jejuni*: Biosynthesis of sialylated ganglioside mimics in the core oligosaccharide. *J Biol Chem* **277**: 327-337
12. Hood, D.W, Cox A.D, Wakarchuk, W.W, Schur, M., Schweda, E.K., Walsh, S.L., Deadman, M.E., Martin, A., Moxon, E.R., and Richards, J.C. (2001) Genetic basis for expression of the major globotetraose-containing lipopolysaccharide from *H. influenzae* strain Rd (RM118). *Glycobiology* **11**:957-67
13. Yan, F., Gilbert, M., Wakarchuk, W., Brisson, J.-R., and Whitfield, D. M., 2001. Chemoenzymatic iterative synthesis of difficult linkages of oligosaccharides on soluble polymeric supports. *Org. Lett.* **3**: 3265-3268.
14. Priem, B., Gilbert, M., Wakarchuk, W. Heyraud, A. and Semain, E. 2001. A new fermentation process allows large scale production of human milk oligosaccharides by metabolically engineered bacteria. *Glycobiology* **11**: 1-6
15. van Belkum, A., van den Braak, N., Godschalk, P.C.R., Ang, C.W., Jacobs, B., Gilbert, M., Wakarchuk, W.W., Verbrugh, H., and Endtz, H.P. 2001: A *Campylobacter jejuni* *cstII* gene associated with immune-mediated neuropathy. *Nat Medicine* **7**:752-753.
16. Wakarchuk, W.W., D. Watson, F. St Michael, J. Li, Y. Wu, J.R. Brisson, N.M. Young, and M. Gilbert. 2001. Dependence of the bi-functional nature of a sialyltransferase from *Neisseria meningitidis* on a single amino acid substitution. *J Biol Chem* **276**: 12785-12790.
17. Persson, K., H.D. Ly, M. Dieckelmann, W.W. Wakarchuk, S.G. Withers, and N.C. Strynadka. 2001. Crystal structure of the retaining galactosyltransferase LgtC from *Neisseria meningitidis* in complex with donor and acceptor sugar analogs. *Nat Struct Biol* **8**: 166-175.
18. Blixt, O., J. Brown, M.J. Schur, W. Wakarchuk, and J.C. Paulson. 2001 .Efficient preparation of natural and synthetic galactosides with a recombinant β -1,4-galactosyltransferase-/UDP-4'-gal epimerase fusion protein. *J Org Chem* **66**: 2442-2448.
19. Mosimann, S.C., M. Gilbert, D. Dombrowski, R. To, W. Wakarchuk, and N.C. Strynadka. 2001. Structure of a sialic acid-activating synthetase, CMP-acylneuraminate synthetase in the presence and absence of CDP. *J Biol Chem* **276**: 8190-8196.
20. Hood, Derek W., Andrew D. Cox, Michel Gilbert, Katherine Makepeace, Shannon Walsh, Mary E. Deadman, Alison Cody, Adele Martin, Martin Månsson, Elke K.H. Schweda, Jean-Robert Brisson, James C. Richards, E. Richard Moxon, and Warren W. Wakarchuk. 2001. Identification of a lipopolysaccharide α -2,3-sialyltransferase from *Haemophilus influenzae* *Mol Microbiol* **39**: 341-350.

21. **Creuzenet, C., M. J. Schur, J. Li, W.W. Wakarchuk, and J.S. Lam.** 2000. FlaA1, a new bifunctional UDP-GlcNAc C6 dehydratase / C4 reductase from *Helicobacter pylori*. *J Biol Chem* **275**: 34873-34880
22. **Creuzenet, C., M. Belanger, W.W. Wakarchuk, and J.S. Lam.** 2000. Expression, purification, and biochemical characterization of WbpP, a new UDP-GlcNAc C4 epimerase from *Pseudomonas aeruginosa* serotype O6. *J Biol Chem* **275**:19060-19067.
23. **Linton, D., M. Gilbert, P.G. Hitchen, A. Dell, H.R. Morris, W.W. Wakarchuk, N.A. Gregson, and B.W. Wren.** 2000. Phase variation of a β -1,3 galactosyltransferase involved in generation of the ganglioside GM1-like lipo-oligosaccharide of *Campylobacter jejuni*. *Mol Microbiol* **37**:501-514
24. **Yan, F., W.W. Wakarchuk, M. Gilbert, J.C. Richards, and D.M. Whitfield.** 2000. Polymer-supported and chemoenzymatic synthesis of the *Neisseria meningitidis* pentasaccharide: a methodological comparison. *Carbohydr Res* **328**: 3-16, 2000.
25. **Logan, S.M., J.W. Conlan, M.A. Monteiro, W.W. Wakarchuk, and E. Altman.** 2000. Functional genomics of *Helicobacter pylori*: identification of a β -1,4 galactosyltransferase and generation of mutants with altered lipopolysaccharide. *Mol Microbiol* **35**:1156-1167.
26. **Sujino, K., Uchiyama, T., Hindsgaul, O., Seto., N. O. L., Wakarchuk, W. and Palcic, M. M.** 2000. Enzymatic synthesis of oligosaccharide donors for three retaining α -galactosyltransferases. *JACS* **122**: 1261-1269
27. **Mehta, S., M. Gilbert, W.W. Wakarchuk, and D.M. Whitfield.** 2000. Ready access to sialylated oligosaccharide donors. *Org Lett* **2**:751-753.
28. **Gilbert, M., J.R. Brisson, M.F. Karwaski, J. Michniewicz, A.M. Cunningham, Y. Wu, N.M. Young, and W.W. Wakarchuk.** 2000. Biosynthesis of ganglioside mimics in *Campylobacter jejuni* OH4384. Identification of the glycosyltransferase genes, enzymatic synthesis of model compounds, and characterization of nanomole amounts by 600-MHz (1)H and (13)C NMR analysis. *J Biol Chem* **275**:3896-3906.
29. **Lougheed, B., H.D. Ly, W.W. Wakarchuk, and S.G. Withers.** 1999. Glycosyl fluorides can function as substrates for nucleotide phosphosugar-dependent glycosyltransferases. *J Biol Chem* **274**:37717-37722.
30. **Zou, W., M. Abraham, M. Gilbert, W.W. Wakarchuk, and H.J. Jennings.** 1999. Allylmalonamide as a bivalent linker: synthesis of biantennary GM3-saccharide--keyhole limpet hemocyanin glycoconjugate and the immune response in mice. *Glycoconj J* **16**:507-515.
31. **Bettler, E., E. Samain, V. Chazalet, C. Bosso, A. Heyraud, D.H. Joziase, W.W. Wakarchuk, A. Imberty, and A.R. Geremia.** 1999. The living factory: in vivo production of N-acetyllactosamine containing carbohydrates in *E. coli*. *Glycoconj J* **16**:205-212.

32. Davoodi, J., W.W. Wakarchuk, W.K. Surewicz, and P.R. Carey. 1998. Scan-rate dependence in protein calorimetry: the reversible transitions of *Bacillus circulans* xylanase and a disulfide-bridge mutant. *Protein Sci* 7:1538-1544.
33. Li, J., P. Thibault, A. Martin, J.C. Richards, W.W. Wakarchuk, and W. van der Wilp. 1998. Development of an on-line preconcentration method for the analysis of pathogenic lipopolysaccharides using capillary electrophoresis-electrospray mass spectrometry. Application to small colony isolates. *J Chromatogr A* 817:325-336.
34. Gilbert, M., R. Bayer, A.M. Cunningham, S. DeFrees, Y. Gao, D.C. Watson, N.M. Young, and W.W. Wakarchuk. 1998. The synthesis of sialylated oligosaccharides using a CMP-Neu5Ac synthetase/sialyltransferase fusion. *Nat Biotechnol* 16:769-772.
35. Wakarchuk, W.W., M. Gilbert, A. Martin, Y. Wu, J.R. Brisson, P. Thibault, and J.C. Richards. 1998. Structure of an α -2,6-sialylated lipooligosaccharide from *Neisseria meningitidis* immunotype L1. *Eur J Biochem* 254:626-633.
36. Wakarchuk, W.W., A. Cunningham, D.C. Watson, and N.M. Young. 1998. Role of paired basic residues in the expression of active recombinant galactosyltransferases from the bacterial pathogen *Neisseria meningitidis*. *Protein Eng* 11:295-302.
37. Gilbert, M., A.M. Cunningham, D.C. Watson, A. Martin, J.C. Richards, and W.W. Wakarchuk. 1997. Characterization of a recombinant *Neisseria meningitidis* α -2,3-sialyltransferase and its acceptor specificity. *Eur J Biochem* 249:187-194.
38. Kolkman, M.A., W. Wakarchuk, P.J. Nuijten, and B.A. van der Zeijst. 1997. Capsular polysaccharide synthesis in *Streptococcus pneumoniae* serotype 14: molecular analysis of the complete cps locus and identification of genes encoding glycosyltransferases required for the biosynthesis of the tetrasaccharide subunit. *Mol Microbiol* 26:197-208.
39. Gilbert, M., David C. Watson, and Warren W. Wakarchuk (1997) Purification and characterization of the recombinant CMP-sialic acid synthetase from *Neisseria meningitidis*. *Biotech. Lett.* 19: 417-420
40. Lawson, S.L., W.W. Wakarchuk, and S.G. Withers. 1997. Positioning the acid/base catalyst in a glycosidase: studies with *Bacillus circulans* xylanase. *Biochemistry* 36:2257-2265.
41. Gilbert, M., D.C. Watson, A.M. Cunningham, M.P. Jennings, N.M. Young, and W.W. Wakarchuk. 1996. Cloning of the lipooligosaccharide α -2,3-sialyltransferase from the bacterial pathogens *Neisseria meningitidis* and *Neisseria gonorrhoeae*. *J Biol Chem* 271:28271-28276
42. Plesniak, L.A., W.W. Wakarchuk, and L.P. McIntosh. 1996. Secondary structure and NMR assignments of *Bacillus circulans* xylanase. *Protein Sci* 5:1118-1135.
43. Plesniak, L.A., G.P. Connelly, W.W. Wakarchuk, and L.P. McIntosh. 1996. Characterization of a buried neutral histidine residue in *Bacillus circulans* xylanase: NMR assignments, pH titration, and hydrogen exchange. *Protein Sci* 5:2319-2328.

44. McIntosh, L.P., G. Hand, P.E. Johnson, M.D. Joshi, M. Korner, L.A. Plesniak, L. Ziser, W.W. Wakarchuk, and S.G. Withers. 1996. The pKa of the general acid/base carboxyl group of a glycosidase cycles during catalysis: a ^{13}C -NMR study of *Bacillus circulans* xylanase. *Biochemistry* **35**:9958-9966.
45. Wakarchuk, W., A. Martin, M.P. Jennings, E.R. Moxon, and J.C. Richards. 1996. Functional relationships of the genetic locus encoding the glycosyltransferase enzymes involved in expression of the lacto-N-neotetraose terminal lipopolysaccharide structure in *Neisseria meningitidis*. *J Biol Chem* **271**:19166-19173.
46. Lawson, S.L., W.W. Wakarchuk, and S.G. Withers. 1996. Effects of both shortening and lengthening the active site nucleophile of *Bacillus circulans* xylanase on catalytic activity. *Biochemistry* **35**:10110-10118.
47. Davoodi, J., W.W. Wakarchuk, R.L. Campbell, P.R. Carey, and W.K. Surewicz. 1995. Abnormally high pKa of an active-site glutamic acid residue in *Bacillus circulans* xylanase. The role of electrostatic interactions. *Eur J Biochem* **232**:839-843.
48. Sung, W.L., C.K. Luk, B. Chan, W. Wakarchuk, M. Yaguchi, R. Campbell, G. Willick, K. Ishikawa, and D.M. Zahab. 1995. Expression of *Trichoderma reesei* and *Trichoderma viride* xylanases in *Escherichia coli*. *Biochem Cell Biol* **73**:253-259.
49. Wakarchuk, W.W., W.L. Sung, R.L. Campbell, A. Cunningham, D.C. Watson, and M. Yaguchi. 1994. Thermostabilization of the *Bacillus circulans* xylanase by the introduction of disulfide bonds. *Protein Eng* **7**:1379-1386.
50. Wakarchuk, W.W., R.L. Campbell, W.L. Sung, J. Davoodi, and M. Yaguchi. 1994. Mutational and crystallographic analyses of the active site residues of the *Bacillus circulans* xylanase. *Protein Sci* **3**:467-475.
51. Sung, W.L., C.K. Luk, D.M. Zahab, and W. Wakarchuk. 1993. Overexpression of the *Bacillus subtilis* and *circulans* xylanases in *Escherichia coli*. *Protein Expr Purif* **4**:200-206.
52. Oku, T., C. Roy, D.C. Watson, W. Wakarchuk, R. Campbell, M. Yaguchi, L. Jurasek, and M.G. Paice. 1993. Amino acid sequence and thermostability of xylanase A from *Schizophyllum commune*. *FEBS Lett* **334**:296-300.
53. Gebler, J., N.R. Gilkes, M. Claeysens, D.B. Wilson, P. Beguin, W.W. Wakarchuk, D.G. Kilburn, R.C.J. Miller, R.A. Warren, and S.G. Withers. 1992. Stereoselective hydrolysis catalyzed by related β -1,4-glucanases and β -1,4-xylanases. *J Biol Chem* **267**:12559-12561.
54. Wakarchuk, W.W., F.W. Muller, and C.F. Beck. 1992. Two GC-rich DNA elements of *Chlamydomonas reinhardtii* with complex arrangements of directly repeated sequence motifs. *Plant Mol Biol* **18**:143-146.
55. Trier, U., S. Fuchs, M. Weber, W. Wakarchuk, and C. Beck (1989). Gametic differentiation in *Chlamydomonas reinhardtii*: Light dependence and Gene Expression Patterns. *Arch. Microbiol.* **152**: 572 - 577.

56. **Wakarchuk, W., W., N.M. Greenberg, D.G. Kilburn, R.C. Miller Jr., and R.A.J. Warren** (1988). Structure and transcription analysis of a gene encoding a cellobiase from an *Agrobacterium* sp. strain ATCC 21400. *J. Bact.* **170** : 301 - 307 .
57. **Wakarchuk, W.W., D.G. Kilburn, R.C. Miller Jr., and R.A.J. Warren** (1987). The molecular cloning and expression of a cellobiase gene from an *Agrobacterium* in *Escherichia coli*. *Mol. Gen. Genet.* **205**: 146 - 152.
58. **Miller, P. B., W.W. Wakarchuk, and R.A.J. Warren** (1985). α - Putresinythymine and the sensitivity of bacteriophage ϕ W-14 DNA to restriction endonucleases. *Nucleic Acids Res.* **13**(7): 2559 - 2568.
59. **Wakarchuk, W.W. D.G. Kilburn, R.C. Miller Jr., and R.A.J. Warren** (1984). The preliminary characterization of the β -glucosidases of *Cellulomonas fimi*. *J. Gen. Microbiol.* **130**: 1385 - 1389.
60. **Gilkes, N.R., D.G. Kilburn, M.L. Langsford, R.C. Miller, Jr., W.W. Wakarchuk, R.A.J. Warren, D.J. Whittle and W.K.R Wong** (1984). Isolation and characterization of *Escherichia coli* clones expressing cellulase genes from *Cellulomonas fimi*. *J. Gen. Microbiol.* **130**: 1377 - 1384.
61. **Langsford, M.L., N.R. Gilkes, W.W. Wakarchuk, D.G. Kilburn, R.C. Miller, Jr., and R.A.J. Warren** (1984). The cellulase system of *Cellulomonas fimi*. *J. Gen. Microbiol.* **130**: 1367 - 1376.

PATENTS

1. Construction of thermostable mutants of a low molecular mass xylanase. **Warren W. Wakarchuk, Wing L. Sung, Robert L. Campbell, David Rose, and Makoto Yaguchi.** U.S. Patent No. 5,405,769, 1995
2. The α -2,3-sialyltransferases from *Neisseria* and their uses.. **Michel Gilbert, N. Martin Young, Richard E. Moxon, Michael P. Jennings and Warren Wakarchuk.** U.S. Patent No. 6,096,529, 2000
3. Campylobacter glycosyltransferases for biosynthesis of gangliosides and ganglioside mimics US Patent 6,503,744 2003. **Michel Gilbert and Warren Wakarchuk.**
4. US Patent application 1998: Construction of enzyme fusions and their use in the synthesis of oligosaccharides. **Michel Gilbert, N. Martin Young and Warren Wakarchuk**
5. US Patent application 1998: α -2,3-sialyltransferase from *Campylobacter jejuni* and its uses. **Michel Gilbert and Warren Wakarchuk.**

INVITED PRESENTATIONS

Invited Speaker at the **INPEC 2003 meeting** . Bromont QC, July 25, 2003. Title: Looking towards the Engineering of Glycosyltransferases.

Invited Speaker at the **Glycobiology 2002 satellite symposium**. Boston MA. Nov. 9, 2002. Title: Structure/ function of glycosyltransferases

Structure-Function Relationships of Glycosyltransferases. What have we learned? **Federal Drug Administration (FDA)**, Bethesda MD, USA, March 14, 2002

Structure-Function Relationships of Glycosyltransferases. What have we learned? **University of Guelph**, Dec. 4, 2001

Invited Speaker at the **Fourth International Carbohydrate Bioengineering meeting**. Stockholm Sweden, June 10-13, 2001. Title: Development of Bacterial Glycosyltransferases for Glycoconjugate Synthesis.

Invited Speaker at the **Second International Glycosyltransferases meeting**. Toronto ON, May12-14, 2000. Title: Bacterial Sialyltransferases: More than meets the eye.

Invited Speaker. **Lecture for the Peter Wall Institute for Advanced Studies**. Vancouver BC. June 22, 2000. Title: Bacterial Sialyltransferases

Invited Speaker at the **Society for Industrial Microbiology 50th anniversary meeting**, Arlington Va., August, 1999. Title : Oligosaccharides and glycosyltransferases from pathogenic bacteria

Seminar presentation at the University of Oxford, July 1996; Title: Cloning and characterization of α -2,3-sialyltransferase from *Neisseria meningitidis* and *Neisseria gonorrhoeae*

Symposium Speaker: Title: Mutational and Crystallographic analysis of Microbial Xylanases. **Plant Polysaccharide Symposium** Nantes, France July 1996.

CONFERENCE PRESENTATIONS/PROCEEDINGS

1. Michel Gilbert, Marie-France Karwaski, Anna-Maria Cunningham and Warren W. Wakarchuk. Title: Modulation of the mono- and bi-functional activity of the *Campylobacter jejuni* Cst-II sialyltransferase: a novel phase variation mechanism. **2nd International Symposium on Glycosyltransferases**, Toronto, May 2000.
2. Michel Gilbert, Anna-Maria Cunningham, Manuela Dieckelmann, Marie-France Karwaski, Stephen Marshall, Joseph Michniewicz, Melissa J. Schur, Frank St. Michael, David C. Watson, N. Martin Young and Warren W. Wakarchuk. Title: Bacterial glycosyltransferases: their study as potential pathogenesis factors and their use as tools for chemo-enzymatic synthesis of biologically active carbohydrates. **Ottawa Life Sciences National Conference**. November 1998
3. Warren W. Wakarchuk, Anna-Maria Cunningham, David C. Watson, and N. Martin Young. Title: Role of paired basic residues in the expression of active recombinant galactosyltransferases from the bacterial pathogen *Neisseria meningitidis*. **Canadian Society For Microbiology** June 14-18, 1998

4. Michel Gilbert, Anna-Maria Cunningham, David C. Watson, Adele Martin, James C. Richards, and Warren W. Wakarchuk. Title: Characterization of a recombinant *Neisseria meningitidis* α -2,3-sialyltransferase with a novel acceptor specificity. **XIV international glyconjugate conference in Zurich Switzerland, Sept 7-12, 1997**
5. Warren Wakarchuk, Anna Cunningham, and Michel Gilbert. Simple synthesis of fluorescent substrates for a capillary electrophoresis based assay of glycosidases and glycosyltransferases using commercially available aminophenylglycosides. **XIII International symposium on glycoconjugates, August 20-26, 1995, Seattle, U.S.A.**
6. W. Wakarchuk, R. Campbell, W. Sung, and M. Yaguchi. Structure of the active site from a xylanase of *Bacillus circulans*. Oral presentation at the **Canadian Federation of Biological Societies, 36th annual meeting, June 1993, Windsor Ontario.**
7. W. Wakarchuk, N. Methot, P. Lanthier, W. Sung, V. Seligy, M. Yaguchi, R. To, R. Campbell, and D. Rose. The 20 KD Xylanase of *Bacillus subtilis*: A Structure/Function Analysis. **Xylan and Xylanases** J. Visser et al ed. Elsevier , 1992. pp 439 - 442
8. M. Yaguchi, C. Roy., M. Ujiie, D. C. Watson, and W. Wakarchuk. Amino Acid Sequence of the Low Molecular Weight Xylanase from *Trichoderma viride*. **Xylan and Xylanases** J. Visser et al, ed. Elsevier , 1992. pp 149 - 154.
9. W. Wakarchuk, N. Methot, W. Sung, V. Seligy, and M. Yaguchi . Structure/Function relationships in the low molecular mass xylanase of *Bacillus subtilis*. Oral presentation to the **American Chemical Society Symposia, Biochemical Technology Section, August 29, 1991**
10. W. Wakarchuk, E. D. v. Gromoff, and C. F. Beck. Identification of v-myc homologous genes in *Chlamydomonas reinhardtii*. Poster presented at the **Cell and Molecular Biology of Chlamydomonas reinhardtii meeting, Cold Spring Harbor, New York, May, 1988**

CONTRIBUTION TO TRAINING OF HIGHLY QUALIFIED PERSONEL

Michel Gilbert Research associate from 01/1995 to 12/2001 promotion to Associate Research Officer of the NRC 12/2001.

Stephan Bernatchez PDF from 09/2000 to 01/2003 promotion to Assistant Research Officer of the NRC 02/2003

Christine Syzmanski Research associate from 09/2000

Manuela Dieckelmann PDF from 08/1998 to 08/2000 now at U. of Queensland Australia

Sukhoon Koh PDF from 02/2000 to 02/2003

Scott Dick PDF from 06/2001 to 06/2004